Paleoceanography and Paleoclimatology

Supporting Information for

20th century $\delta^{18}O$ seawater and salinity variations reconstructed from paired $\delta^{18}O$ and Sr/Ca measurements of a La Reunion coral

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Additional Supporting Information (Files uploaded separately)

Introduction

This supporting information (SI) provides background information on coral Sr/Ca, $\delta^{18}O$ and $\delta^{18}O$ seawater data from the La Reunion coral core. The oxygen isotopes were first presented in Pfeiffer et al. (2004). This SI includes additional figures of the study site (Figure S1 and S2) and the x-ray images of the *Porites* core (Figure S3). Figure S4 shows Slab 377 together with representative SEM images and Mg/Ca and Sr/Ca profiles, indicating that diagenesis influences the coral proxies prior to 1913. Figure S5 shows the wavelet power spectra of the monthly coral Sr/Ca and the bimonthly coral $\delta^{18}O$ and $\delta^{18}O$ seawater records. All three proxy time series are provided in Data Set S1.

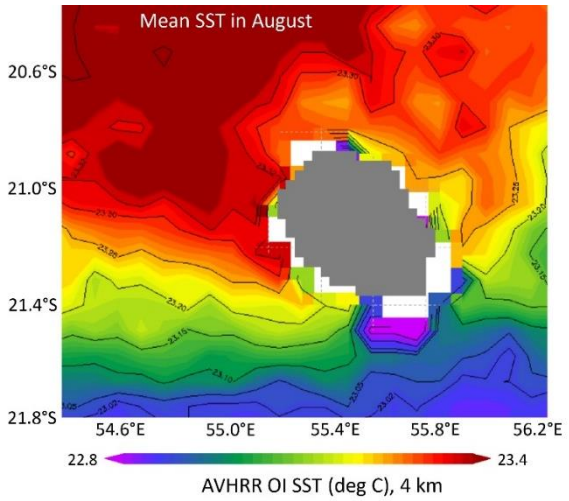

Figure S1. AVHRR OI SST (4km resolution) around La Reunion Island showing windward/leeward effect. Shown is mean monthly SST for August. Chart computed with Live Access Server LAS8.6 (http:/ /apdrc.soest.hawaii.edu, date of access 26/03/2019).

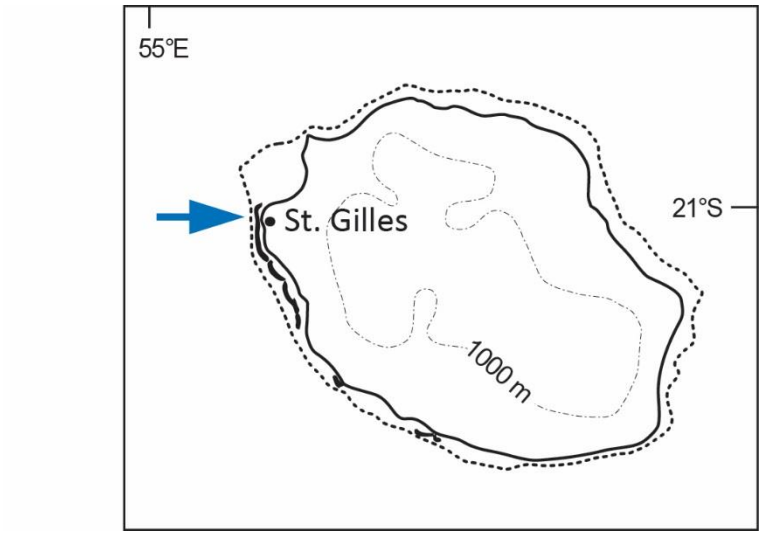

Figure S2. Map of Reunion Island with location of coral core (arrow). Coral reefs are indicated in black. The thick dashed line delineates the 100 m isobath. The dash-dotted line indicates the 1000 m contour.

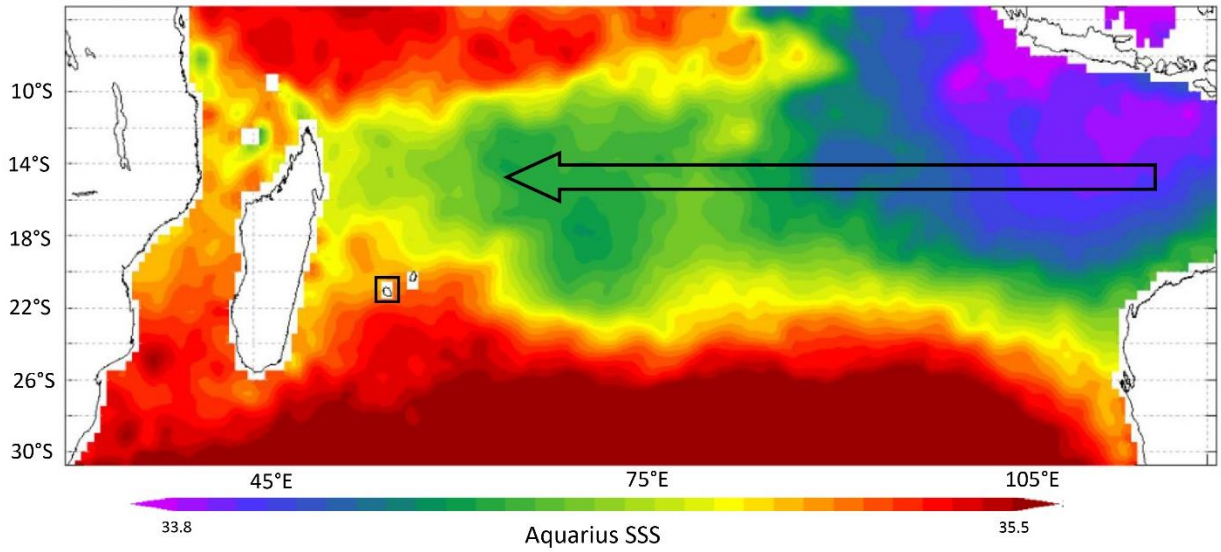

Figure S3. Map of mean monthly SSS (Aquarius OISSS, 1x1° grid) during August 2013 in the southern tropical Indian Ocean. The SEC can be seen as a low-salinity, warm water current that carries low salinity water from the Indonesian Troughflow towards the west. The location of La Reunion is indicated by a black rectangle. Charts computed with Live Access Server LAS8.6 (http://apdrc.soest.hawaii.edu, date of access 26/03/2019).

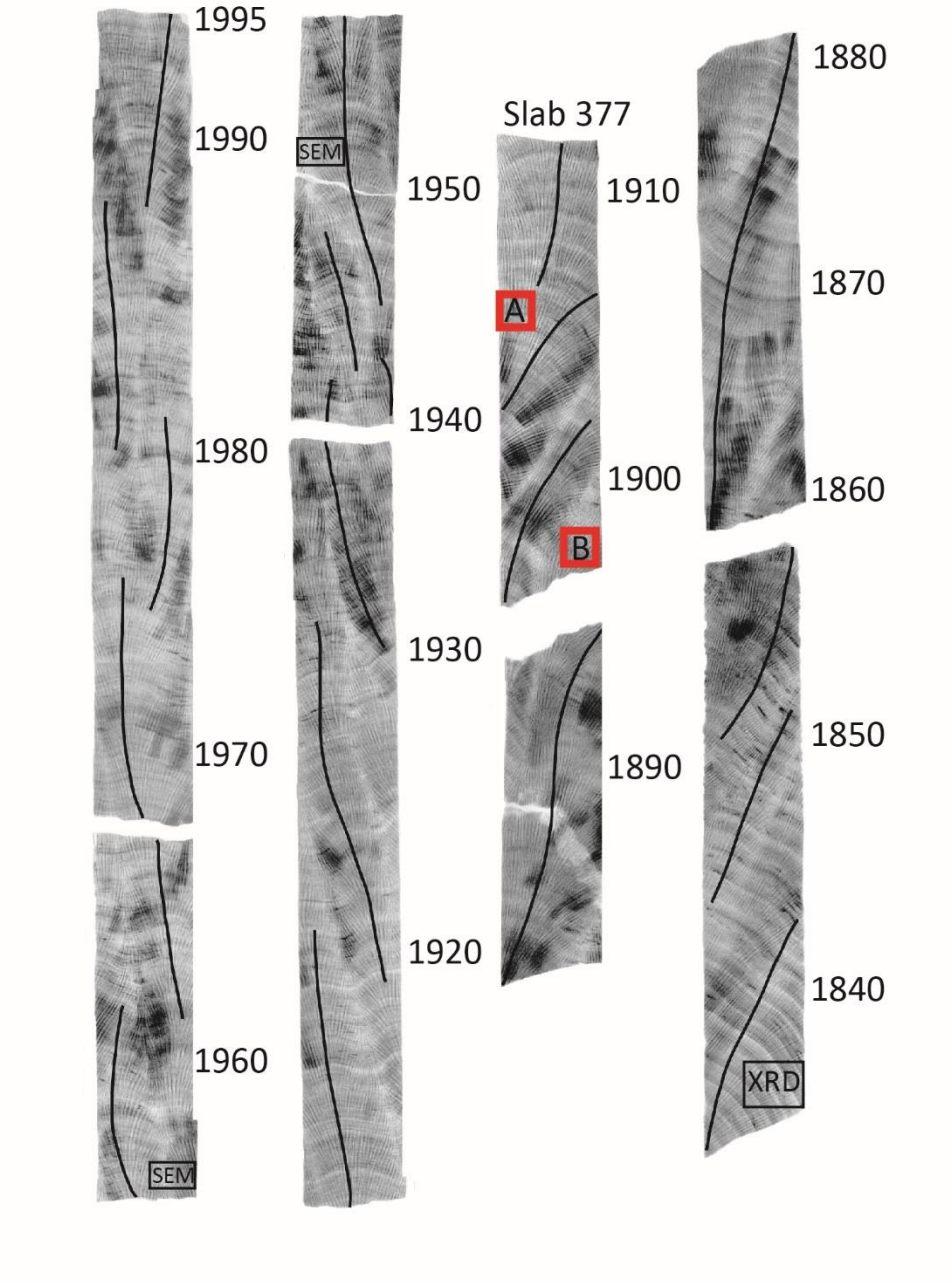

Figure S4. X-ray image of the La Reunion coral with sampling track indicated (for an example of $\delta^{18}O$ and Sr/Ca subsampling see slab 377 in Fig. S5). Location of SEM and XRD samples are indicated by black squares. Slab 377 and SEM images shown in Fig. S5 are indicated in red.

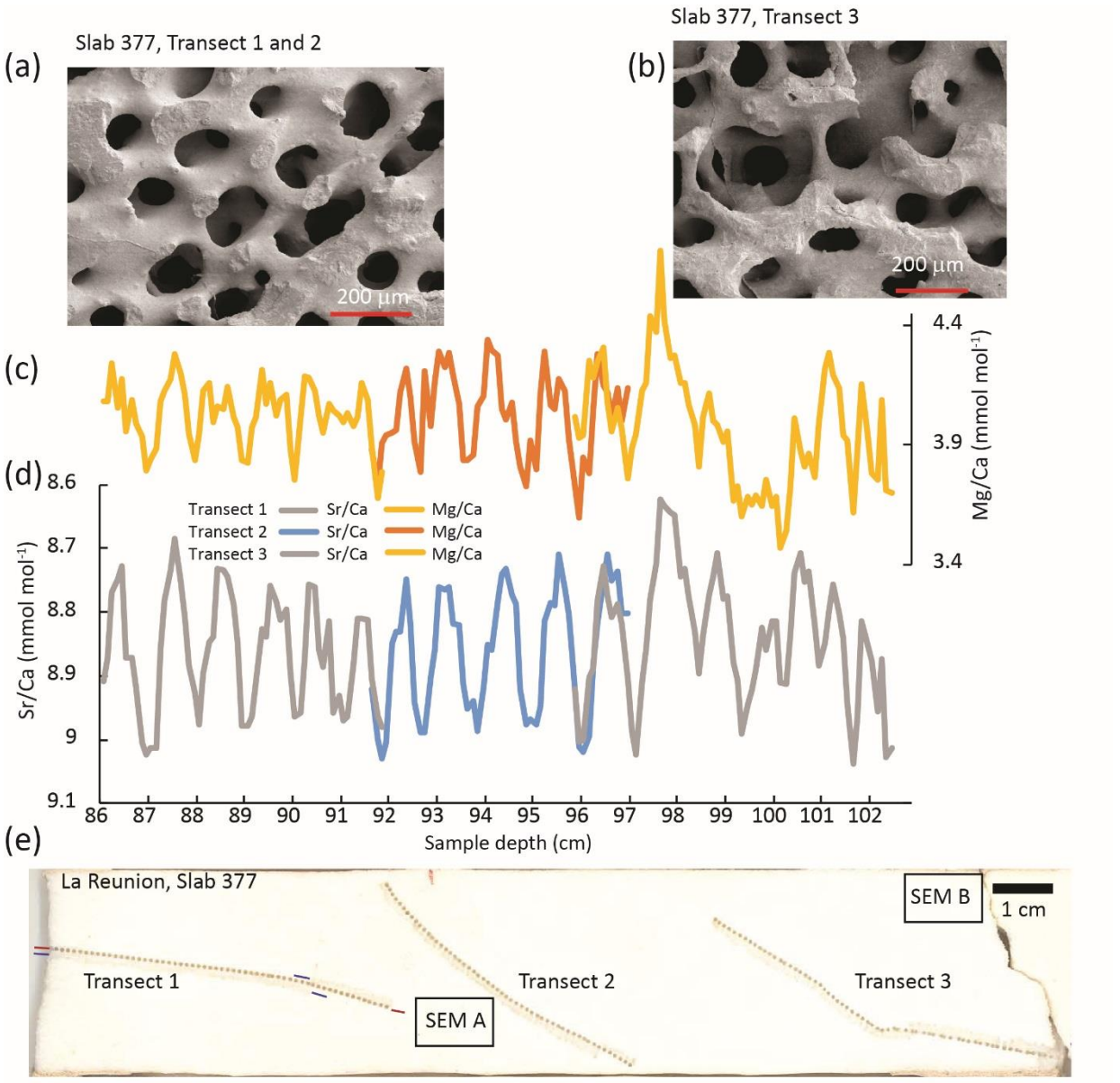

Figure S5. (a) and (b): SEM images of the La Reunion coral, (a) showing pristine skeletal aragonite and (b) small but pervasive amounts aragonite cements. (c) Mg/Ca ratios measured along the three sampling transects along slab 377. (d) Sr/Ca rations measured along the three sampling transects along slab 377. (e) Slab 377 (photo) with sampling transects and location of SEM images indicated. Red [blue] lines mark beginning and end of $\delta^{18}O$ [Sr/Ca] sampling tracks on transect 1. All subsamples are collected at 1mm increments. For $\delta^{18}O$ [Sr/Ca], every second [every 1mm] sample was analyzed. Note the close alignment of Sr/Ca and $\delta^{18}O$ subsamples.

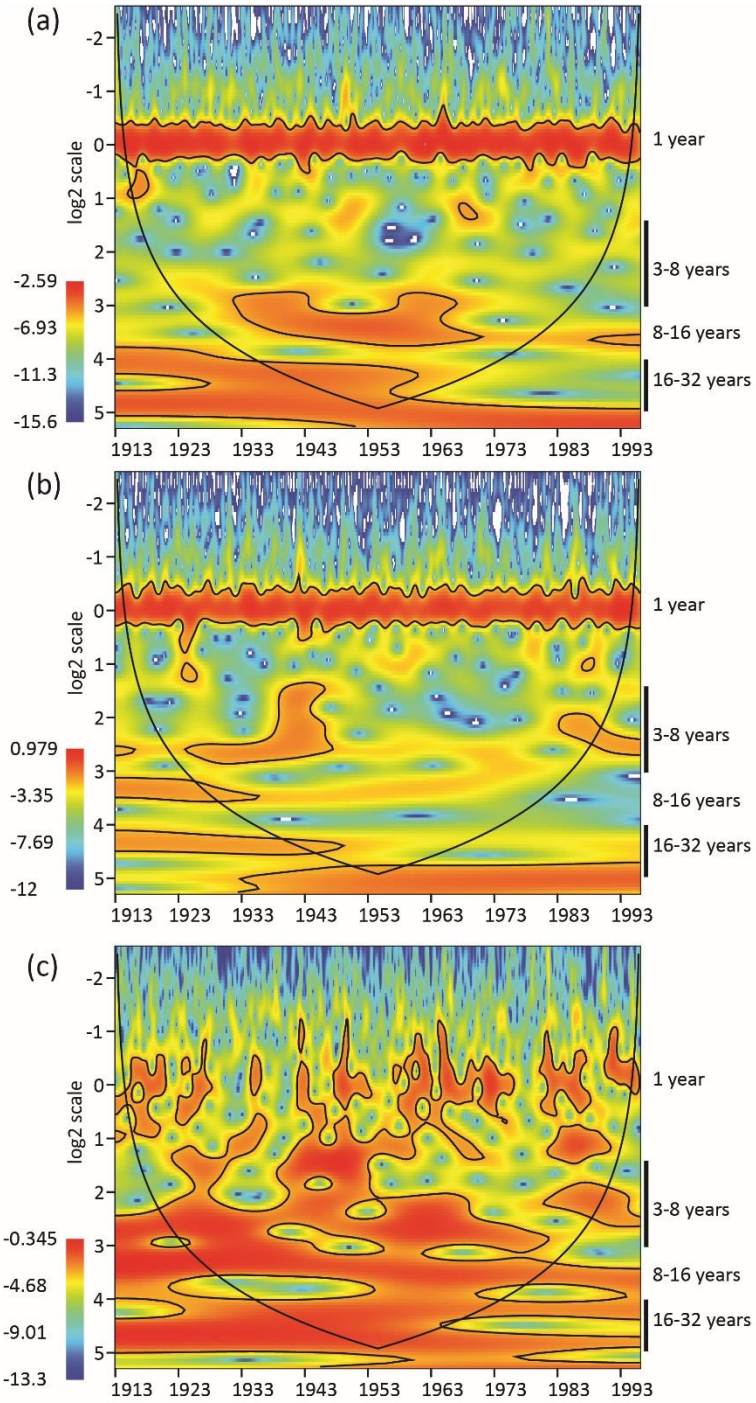

Figure S6. Wavelet power spectra of (a) monthly coral Sr/Ca, (b) bimonthly coral $\delta^{18}O$ and (c) bimonthly coral $\delta^{18}O$ seawater. Wavelet power spectra were computed using the Morlet wavelet. The cone of influence and the 95% confidence level are indicated by the black lines. All spectra were computed with the free software package PAST.

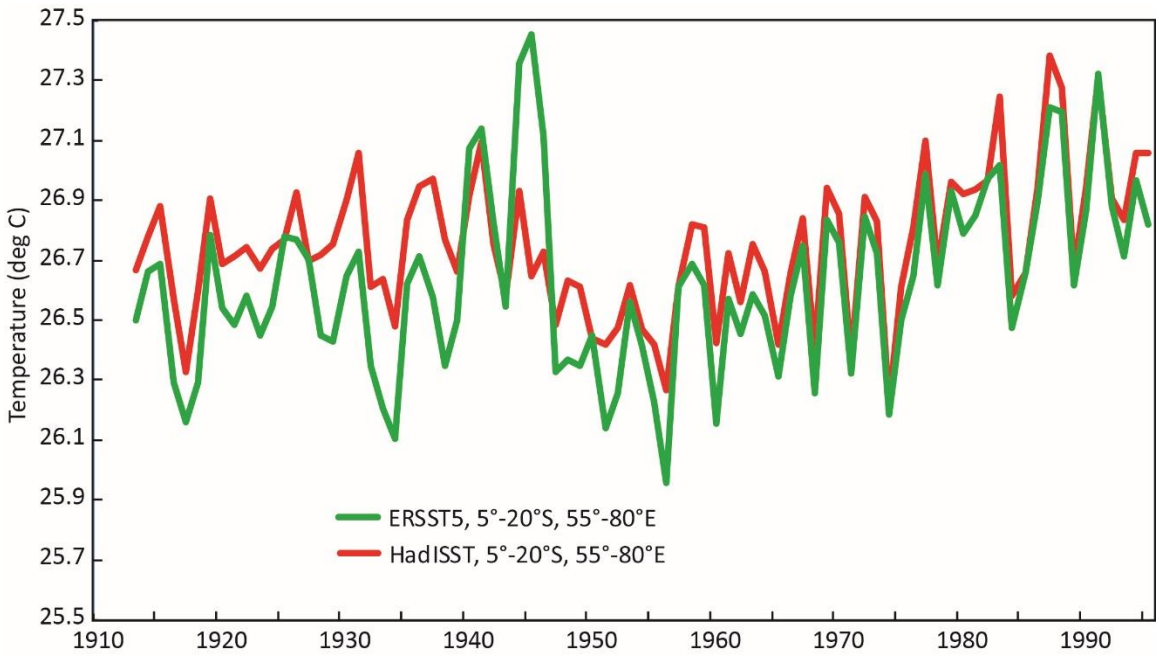

Figure S7. Annual mean SSTs from gridded products (ERSST 5 and HadISST) averaged over the SW Indian Ocean (5°-20°S, 55°-80°E). The data is used for computing $\delta^{18}O_{sw}$ shown in Fig. 8 of the manuscript.

min-max	slope	95% CI	r	p	N
Sr/Ca	-0.043	(-0.050/-0.036)	-0.93	<0.01	47
$\delta^{18}O$	-0.16	(-0.18/-0.13)	-0.93	<0.01	47

Table S1. OLS regression of seasonal maxima/minima of coral Sr/Ca and $\delta^{18}O$ vs. OI SST (55°E, 21°S; 1982-1995; Reynolds et al., 2002).

annual mean	slope	95% CI	r	p	N
$\delta^{18}O$					
HadSST3	-0.02	(-0.11/0.10)	-0.07	>0.5	29
ERSST5	-0.01	(-0.15/0.09)	-0.02	>0.5	29
HadISST	-0.02	(-0.11/0.09)	-0.06	>0.5	29
Sr/Ca					
HadSST3	-0.068	(-0.090/-0.043)	-0.69	<0.01	29
ERSST5	-0.051	(-0.089/-0.023)	-0.45	<0.1	29
HadISST	-0.063	(-0.083/-0.039)	-0.67	<0.01	29

Table S2. OLS regression of annual mean coral $\delta^{18}O$ and Sr/Ca vs. historical SST in the SW Indian Ocean (55-80°E, 5-20°S; 1966-1995).

Data Set S1. Monthly Sr/Ca (1913 to 1995), bimonthly $\delta^{18}O$ (1913 to 1995) and bimonthly $\delta^{18}O$ seawater (1913-1995) of the La Reunion coral, the latter calculated following Cahyarini et al. (2008), using a Sr/Ca ($\delta^{18}O$)-SST relationship of -0.06 mmol/mol per 1°C (-0.2 permil per 1°C).